

CLAIMS

What is claimed is:

1. An endoscope comprising:

a handle; and

a shaft extending from the handle, the shaft having a front end comprising a first active deflection section including a plurality of rings pivotably connected to each other and a second active deflection section including a plurality of rings pivotably connected to each other, wherein the first active deflection section is limited to deflection in a first plane and the second active deflection section is limited to deflection in a second different plane, and wherein the first plane is angled to the second plane.

2. An endoscope as in claim 1 wherein the first plane is about 75° to about 90° relative to the second plane.

3. An endoscope as in claim 1 wherein the second active deflection section is limited to deflect only in left and right directions relative to the handle.

4. An endoscope as in claim 3 wherein the first active deflection section is limited to deflect only in upward and downward directions relative to the second active deflection section.

5. An endoscope as in claim 1 wherein the first active deflection section is adapted to deflect through an angle of about 110° to about 210° .

6. An endoscope as in claim 5 wherein the second active deflection section is adapted to deflect through an angle of about 110° to about 210°.

7. An endoscope as in claim 1 wherein the handle comprises a control section comprising a first actuator for moving only the first active deflection section and a second actuator for moving only the second active deflection section, and at least one brake actuator, the at least one brake actuator comprising a first brake actuator being adapted to lock only one of the active deflection section at a desired position.

8. An endoscope as in claim 7 wherein the at least one brake actuator comprises only one brake.

9. An endoscope as in claim 1 wherein the endoscope comprises a cystoscope comprising means for viewing 360° inside of a generally spherical shape through a fixed entrance into the generally spherical shape by a camera or an optical lens at the front end of the shaft without axially rotating the shaft.

10. An endoscope as in claim 1 wherein the first active deflection section comprises rings pivotably connected to each other to form a frame of the first active deflection section, wherein a connection of the rings to each other comprises balls located in sockets of the rings and at least one connecting member extending through a hole in the balls.

11. A nephroscope adapted to be inserted through an incision in a renal pelvis of a patient, the nephroscope comprising:

a handle having a control section; and
a shaft extending from the handle, the shaft comprising a front end with a first active deflection section connected in series with a second active deflection section, the control section being adapted to independently deflect the first and second deflection sections, wherein the first and second active deflection sections are adapted to deflect such that a distal end of the nephroscope can be placed in a calyx of a lower pole of a kidney without the need to passively deflecting the front end of the shaft against tissue of the kidney of a patient to reach the calyx of the lower pole, and wherein the first and second active deflection sections are each limited to deflection in a single common plane relative to each other.

12. A nephroscope as in claim 11 wherein the first active deflection section is adapted to deflect through an angle of about 180° to about 210° .

13. A nephroscope as in claim 11 wherein the control section comprises a first actuator for moving the first active deflection section and a second actuator for moving the second active deflection section, and at least one brake actuator, the at least one brake actuator comprising a first brake actuator being adapted to lock only the second active deflection section at a desired position.

14. A nephroscope as in claim 13 wherein the at least one brake actuator comprises only the first brake actuator.

15. A nephroscope as in claim 11 wherein the first active deflection section comprises a first shape-memory frame member having a general tubular shape comprised of superelastic material, and wherein the second active deflection section comprises a second shape-memory frame member having a general tubular shape comprised of superelastic material.

16. A nephroscope as in claim 15 wherein the second frame member has a curved pre-shaped home position.

17. A nephroscope as in claim 16 wherein the second frame member is maintained in a straight position by tension from a control wire from the control section.

18. A method of viewing an area inside a patient with an endoscope, the method comprising steps of:

- a) moving a second user actuated control of the endoscope to move a second active deflection section at a front end of a shaft of the endoscope, the second active deflection section being limited to movement along a single plane, the step of moving the second user actuated control moving a distal tip of the shaft of the endoscope along a first path limited to the plane without moving a first user actuated control of the endoscope;
- b) moving the first user actuated control to move a first active deflection section at the front end of the shaft to move the distal tip in a second path angled relative to the first path at an angle of about 73° - 90° without moving the second user actuated control; and

c) repeating steps a) and b) for methodically scanning the area inside the patient by a series of adjacent parallel ones of the first paths.

19. A cysto-nephroscope comprising:

a handle;

a shaft extending from the handle, the shaft having a front end comprising a first active deflection section and a second active deflection section, wherein the first active deflection section is limited to deflection in a first plane and the second active deflection section is limited to deflection in a second different plane, wherein the first plane is angled to the second plane, and wherein the first active deflection section comprises rings which are each pivotably connected to an adjacent ring by two ball sections on opposite sides of each ring; and

means for viewing an inside of a generally spherical shape through a fixed entrance into the generally spherical shape by an optical lens at the front end of the shaft without axially rotating the shaft.

20. A cysto-nephroscope as in claim 19 further comprising a connecting member extending through holes in all of the ball sections on one of the sides.

AMENDED CLAIMS

[received by the International Bureau on 3 October 2001 (03.10.03);
original claims 1 and 19 amended; remaining claims unchanged new claim 20 added (5 pages)]

What is claimed is:

1. An endoscope comprising:

a handle; and

a shaft extending from the handle, the shaft having a front end comprising a first active deflection section including a plurality of rings pivotably connected to each other and a second active deflection section including a plurality of rings pivotably connected to each other, wherein the first active deflection section is limited to deflection in a first plane and the second active deflection section is limited to deflection in a second different plane, and wherein the first plane is angled to the second plane.

2. An endoscope as in claim 1 wherein the first plane is about 75° to about 90° relative to the second plane.

3. An endoscope as in claim 1 wherein the second active deflection section is limited to deflect only in left and right directions relative to the handle.

4. An endoscope as in claim 3 wherein the first active deflection section is limited to deflect only in upward and downward directions relative to the second active deflection section.

5. An endoscope as in claim 1 wherein the first active deflection section is adapted to deflect through an angle of about 110° to about 210° .

6. An endoscope as in claim 5 wherein the second active deflection section is adapted to deflect through an angle of about 110° to about 210°.
7. An endoscope as in claim 1 wherein the handle comprises a control section comprising a first actuator for moving only the first active deflection section and a second actuator for moving only the second active deflection section, and at least one brake actuator, the at least one brake actuator comprising a first brake actuator being adapted to lock only one of the active deflection section at a desired position.
8. An endoscope as in claim 7 wherein the at least one brake actuator comprises only one brake.
9. An endoscope as in claim 1 wherein the endoscope comprises a cystoscope comprising means for viewing 360° inside of a generally spherical shape through a fixed entrance into the generally spherical shape by a camera or an optical lens at the front end of the shaft without axially rotating the shaft.
10. An endoscope as in claim 1 wherein the first active deflection section comprises rings pivotably connected to each other to form a frame of the first active deflection section, wherein a connection of the rings to each other comprises balls located in sockets of the rings and at least one connecting member extending through a hole in the balls.
11. A nephroscope adapted to be inserted through an incision in a renal pelvis of a patient, the nephroscope comprising:

a handle having a control section; and

a shaft extending from the handle, the shaft comprising a front end with a first active deflection section connected in series with a second active deflection section, the control section being adapted to independently deflect the first and second deflection sections, wherein the first and second active deflection sections are adapted to deflect such that a distal end of the nephroscope can be placed in a calyx of a lower pole of a kidney without the need to passively deflecting the front end of the shaft against tissue of the kidney of a patient to reach the calyx of the lower pole, and wherein the first and second active deflection sections are each limited to deflection in a single common plane relative to each other.

12. A nephroscope as in claim 11 wherein the first active deflection section is adapted to deflect through an angle of about 180° to about 210° .

13. A nephroscope as in claim 11 wherein the control section comprises a first actuator for moving the first active deflection section and a second actuator for moving the second active deflection section, and at least one brake actuator, the at least one brake actuator comprising a first brake actuator being adapted to lock only the second active deflection section at a desired position.

14. A nephroscope as in claim 13 wherein the at least one brake actuator comprises only the first brake actuator.

15. A nephroscope as in claim 11 wherein the first active deflection section comprises a first shape-memory frame member having a general tubular shape comprised of superelastic material, and wherein the second active deflection section comprises a second shape-memory frame member having a general tubular shape comprised of superelastic material.

16. A nephroscope as in claim 15 wherein the second frame member has a curved pre-shaped home position.

17. A nephroscope as in claim 16 wherein the second frame member is maintained in a straight position by tension from a control wire from the control section.

18. A method of viewing an area inside a patient with an endoscope, the method comprising steps of:

- a) moving a second user actuated control of the endoscope to move a second active deflection section at a front end of a shaft of the endoscope, the second active deflection section being limited to movement along a single plane, the step of moving the second user actuated control moving a distal tip of the shaft of the endoscope along a first path limited to the plane without moving a first user actuated control of the endoscope;
- b) moving the first user actuated control to move a first active deflection section at the front end of the shaft to move the distal tip in a second path angled relative to the first path at an angle of about 73° - 90° without moving the second user actuated control; and

c) repeating steps a) and b) for methodically scanning the area inside the patient by a series of adjacent parallel ones of the first paths.

19. A cysto-nephroscope comprising:

a handle;

a shaft extending from the handle, the shaft having a front end comprising a first active deflection section and a second active deflection section, wherein the first active deflection section is limited to deflection in a first plane and the second active deflection section is limited to deflection in a second different plane, wherein the first plane is angled to the second plane, and wherein the first active deflection section comprises rings which are each pivotably connected to an adjacent ring by two ball sections on opposite sides of each ring; and

means for viewing an inside of a generally spherical shape through a fixed entrance into the generally spherical shape by an optical lens at the front end of the shaft without axially rotating the shaft.

20. A cysto-nephroscope as in claim 19 further comprising a connecting member extending through holes in all of the ball sections on one of the sides.